# Space Weather Technical Forecast

Issued on Monday, 11 April 2022 at 13:15 Local

**This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales**

---

**Space Weather Forecast Headline: Increasing chance of G1/Minor Geomagnetic Storms through the period, becoming likely by Day 4 (14 Apr). Chance of Active fluence.**

**Analysis of Space Weather Activity over past 24 hours**
**Solar Activity:** Solar activity has been Low over the past 24 hours, with a filament eruption from a plage region near south centre disc giving a C1 flare at 11/0521 UTC. This eruption also looks like it has produced an Earth directed CME with a full halo showing in SOHO coronagraph imagery, although full analysis of this event is ongoing. There is now one sunspot region on the Earth-facing disc. AR2983 has faded and is no longer visible, which may be partly due to its proximity to the northwest limb. A new region has emerged in the northeast quadrant, but this is currently small and simple.

**Solar Wind / Geomagnetic Activity:** The solar wind, as measured by DSCOVR at L1, was indicative of an ongoing HSS from CH72. The wind speed has varied between 450-550 km/s. The density has been fairly steady at average levels. The interplanetary magnetic field (IMF), Bt, was moderate to start but soon became mostly weak. The north-south component, Bz, ranged between +/-6 nT, but has been largely southward directed. The Phi angle has been predominantly negative (towards the Sun). Geomagnetic activity has been Quiet to Active (Kp 2-4).

**Energetic Particles / Solar Radiation:** The high energy proton flux (10 MeV) measured at GOES-16 at GEO was at background levels. The high energy (greater than 2MeV) electron flux was mostly at normal background levels, but just reached moderate levels towards the end of the period. The corresponding 24-hour fluence was on a slight decreasing trend, with 4.02e6 integrated pfu observed at 11/0000 UTC.

**Four-Day Space Weather Forecast Summary**
**Solar Activity:** Solar activity is expected to be Very Low, with only one small and simple sunspot on the disc. There is just a Slight Chance of further C-class flares through the forecast period.

**Solar Wind / Geomagnetic Activity:** There is the possibility of a CME arrival either late on Day 2 (12 Apr) or more likely during Day 3 (13 Apr), from a filament liftoff on 9th. A further CME from a filament eruption occurred earlier on 11th. This feature has yet to be fully analysed, but is almost certainly Earth directed. Timings haven't been fully assessed, but the most likely arrival is on Day 4 (14 Apr). Current HSS effects from CH72 are giving elevated solar wind speeds, and expected to continue to do so through Day 1 (11 Apr) and into early Day 2 before slowly easing. Geomagnetic activity is forecast to be Quiet to Active, with a slight chance of G1/Minor Storms on Day 1. There is also a chance of G1/Minor Storms later Day 2 or on Day 3 should the CME from 09 April give a glancing blow, then G1/Minor Storm becomes likely with a slight chance of G2/Moderate Storm on Day 4 with the CME from 11 April arriving.

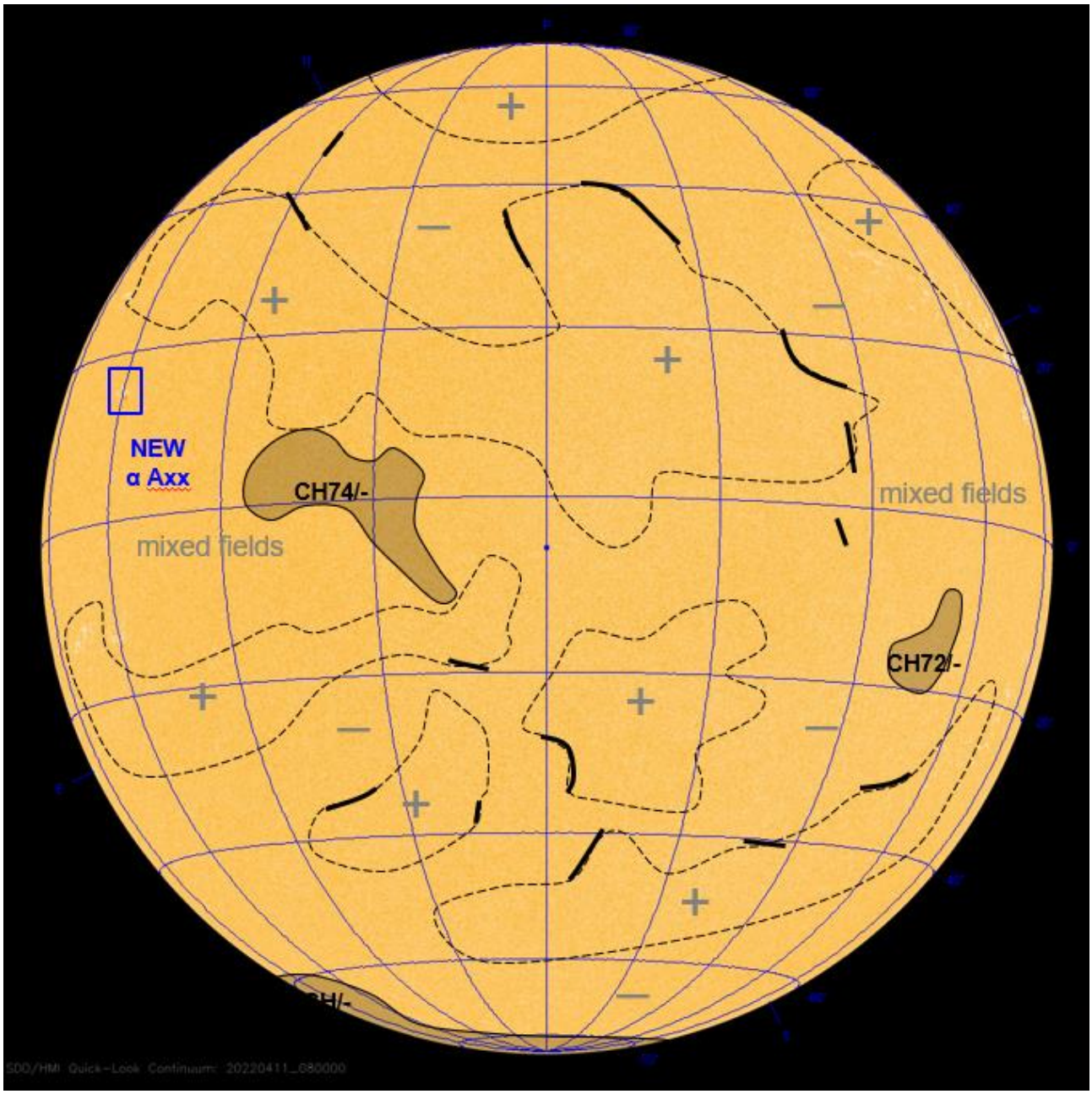
**Energetic Particles / Solar Radiation:** The high energy (greater than 10 MeV) proton flux is expected to persist at background levels. The high energy (greater than 2 MeV) electron flux is

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

forecast to start at background levels, perhaps rising to peak at High levels on Days 1 and 2 (11-12 Apr), before a further CME arrival is likely to suppress levels for a short spell on Day 3 (13 April). The associated 24 hour fluence is likely to remain below the Active threshold throughout the period, but with a probable erratic rising trend through the period.

**Figure 1. Solar Analysis Valid 11/0800 UTC.**




**Key:** Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

## Geomagnetic Storms:

A large filament in the southwest of the disc lifted off on 9th Apr. The associated CME was largely southward directed, but there appears to be some ejecta earthbound on LASCO C2/C3 imagery, and ENLIL depicts a possible glancing blow. If this CME arrives, it is currently anticipated to occur either late on Day 2 (12 Apr) or more likely during Day 3 (13 Apr). A further CME from a filament eruption occurred earlier on 11 April. This feature has yet to be fully analysed, but is almost certainly Earth directed. Timings haven't been fully assessed, but the most likely arrival is on Day 4 (14 Apr).

Current HSS effects from CH72 are giving elevated solar wind speeds at L1. This feature is expected to continue to give elevated wind speeds through Day 1 (11 Apr) and into early Day 2 before slowly easing. The magnetic field has now reduced to weak levels again, which reduces the chance of any G1/Minor Storm intervals.

Geomagnetic activity is forecast to be Quiet to Active, with a slight chance of G1/Minor Storms on Day 1. There is also a chance of G1/Minor Storms later Day 2 or on Day 3 should the CME from 09 April give a glancing blow, then G1/Minor Storm becomes likely with a slight chance of G2/Moderate Storm on Day 4 with the CME from 11 April arriving.

| Geo-Magnetic Storm<br>Probability (Exceedance) | Level | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC)<br>(%) | Day 2 (00-24 UTC)<br>(%) | Day 3 (00-24 UTC)<br>(%) | Day 4 (00-24 UTC)<br>(%) |
|---|---|---|---|---|---|---|
| Minor or Moderate | G1 to G2 | No | 10 | 30 | 40 | 60 |
| Strong | G3 | No | 1 | 1 | 1 | 2 |
| Severe | G4 | No | 1 | 1 | 1 | 1 |
| Extreme | G5 | No | 1 | 1 | 1 | 1 |

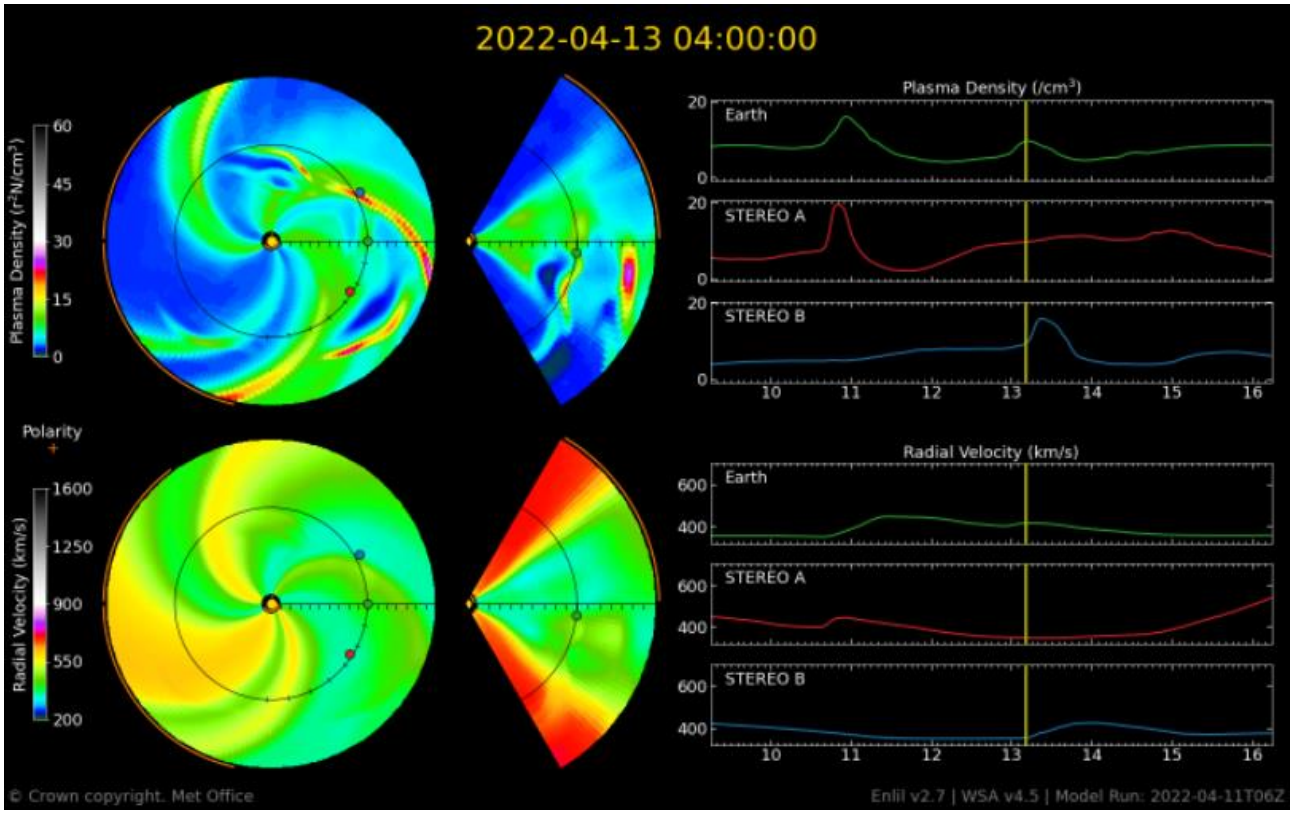
## Geomagnetic Activity - Earthbound Coronal Mass Ejections

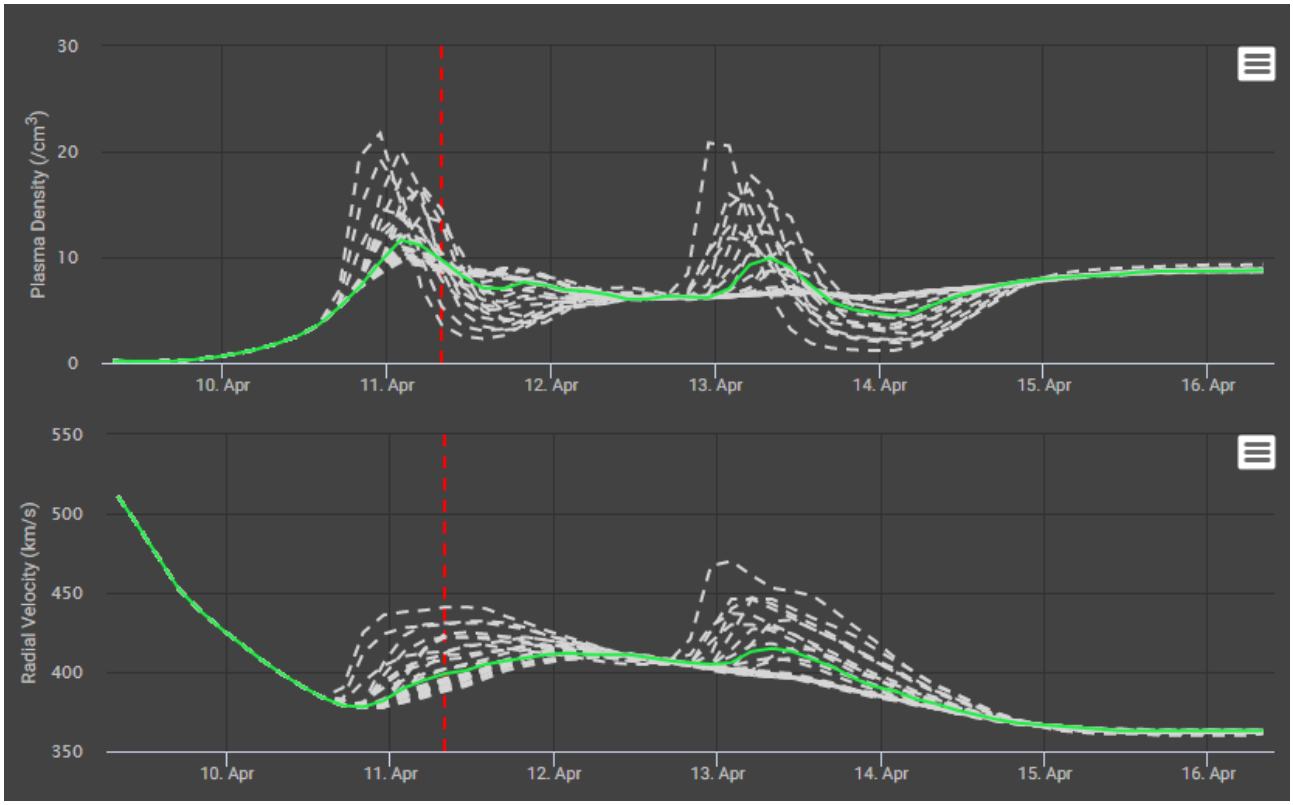
| Date/time 21.5R (UTC) | Halo: Full or Partial | Source | Source Location | Estimated Speed | Estimated Arrival Time | Comments |
|---|---|---|---|---|---|---|
| 09/2010 | Partial | Filament | SW | 500 | 13/0100 | Glancing blow possible |
| Not yet known | Full | Filament eruption | South centre disc | Not yet known | Likely on 14th April | Still undergoing assessment |

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

**Figure 2: Enlil model and ensemble showing a possible CME arrival either later on 12 April or on 13 April. The bulk of the ejecta is expected to go south below Earth's orbit.**

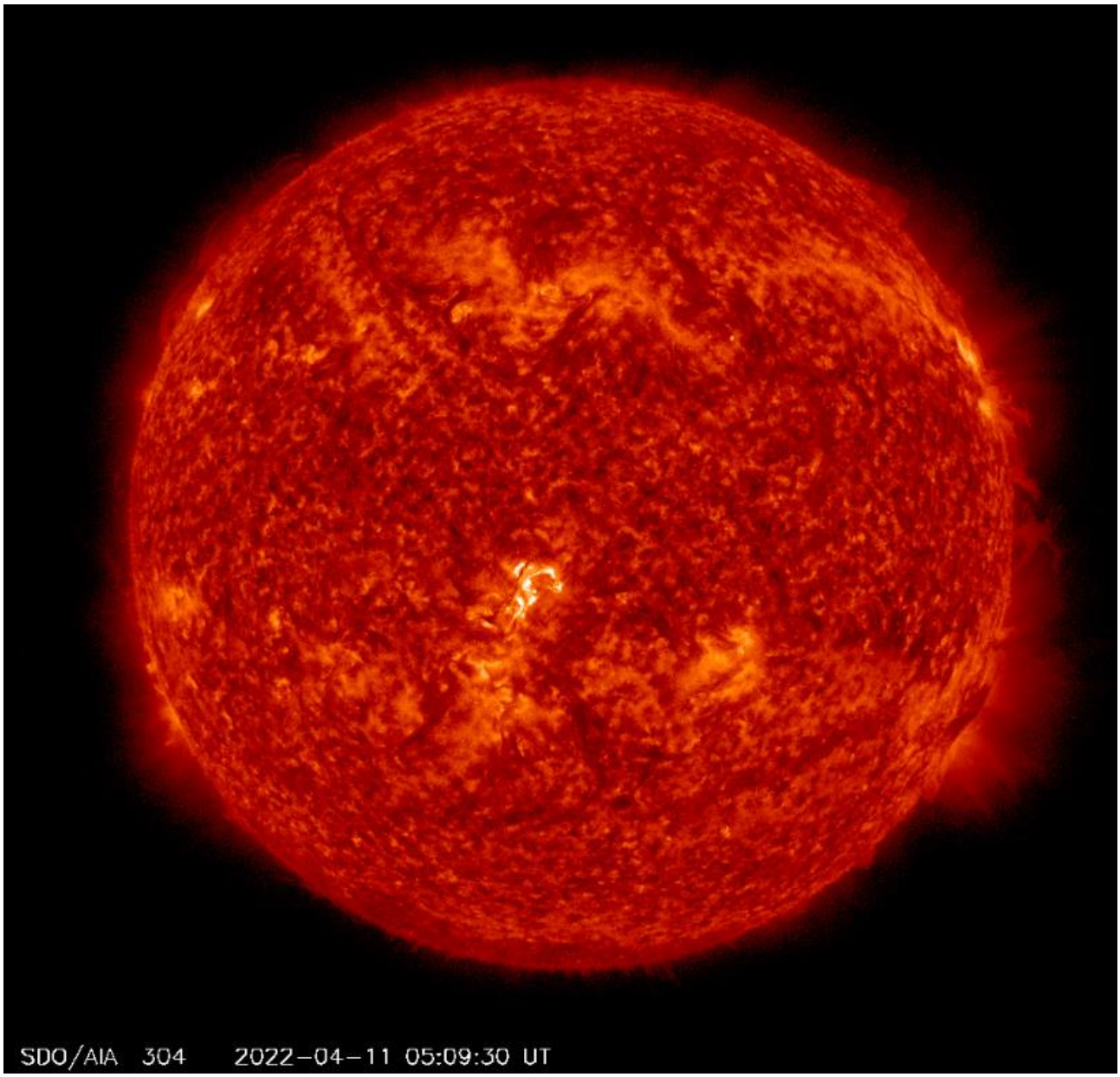



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

**Figure 3: Filament eruption near south centre disc earlier on 11 April giving an Earth directed CME.**




Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

## Radio Blackouts - X-Ray Flares:

There is now one sunspot region on the Earth-facing disc. AR2983 has now faded, which may be in part due to its proximity to the northwest limb, and is now no longer included as a sunspot region. It will contribute a small amount to flare probabilities until it is over the limb however. A new region has developed in the northeast quadrant, which is currently a small and simple Axx/Alpha region.

Recent activity has been Low, with one C-flare associated with a filament eruption from a plage region near south centre disc. However, future activity is expected to be mostly Very Low with only one small sunspot region on the disc. One further possible region may rotate onto the southeast limb in the coming days, but it doesn't currently look particularly active in STEREO-A imagery.

| X Ray Flares<br>Probability | Level | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC)<br>(%) | Day 2 (00-24 UTC)<br>(%) | Day 3 (00-24 UTC)<br>(%) | Day 4 (00-24 UTC)<br>(%) |
|---|---|---|---|---|---|---|
| Active | R1-R2 M Class | No | 1 | 1 | 1 | 1 |
| Very Active | R3 to R5 X Class | No | 1 | 1 | 1 | 1 |

## Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as measured by GOES-16 at GEO is at background and in the absence of complex sunspots on the Earth-facing disc is expected to remain at this level.

| Radiation Storms<br>Probability (Exceedance) | Level ($cm^{-2}$ $sr^{-1}$ $s^{-1}$) | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC)<br>(%) | Day 2 (00-24 UTC)<br>(%) | Day 3 (00-24 UTC)<br>(%) | Day 4 (00-24 UTC)<br>(%) |
|---|---|---|---|---|---|---|
| Active | ≥ S1 | No | 1 | 1 | 1 | 1 |
| Very Active | ≥ S3 * | No | 1 | 1 | 1 | 1 |

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.

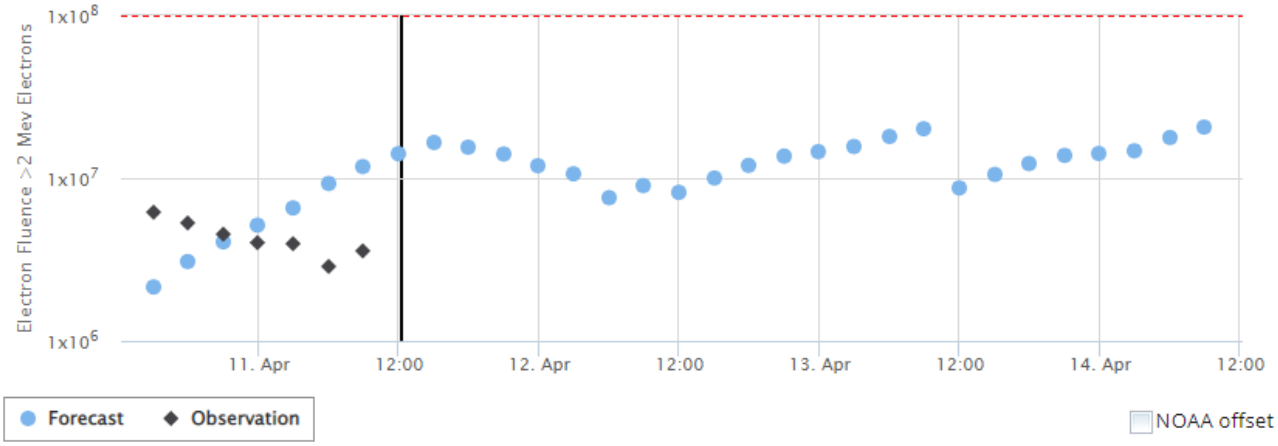
## High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2MeV), as observed by GOES-16 at GEO, has remained mostly at normal background levels through the last 24 hours. As the effects from the current HSS wane, radiation belts are expected to decompress and if electron charging has occurred flux may peak at High levels during Days 1 and 2 (11-12 Apr). Then a possible CME arrival late on Day 2 or early Day 3 (12-13 Apr) may suppress flux levels for a short spell.

The associated 24 hour fluence is below the Active (1e8 integrated pfu) threshold and is likely to remain below through the forecast period, although a rising trend is probable on Days 1 and 2. A decline is then likely for a spell on Day 3 in response to potential CME effects before a possible resumption in the upward trend. Met Office REFM output will not be taking account of CME effects, although now appears to have assimilated the effects of the HSS. As such it is now showing a rising trend below the Active threshold, which is reasonable guidance, but won't be taking account of any suppression if we get a CME arrival on Days 2 or 3.

| GEO Electron Environment | Level ($cm^{-2}$ $sr^{-1}$ $day^{-1}$) | Past 24 Hours (Yes/No) | Day 1 (00-24 UTC) | Day 2 (00-24 UTC) | Day 3 (00-24 UTC) | Day 4 (00-24 UTC) |
|---|---|---|---|---|---|---|
| Probability (Exceedance) | | | (%) | (%) | (%) | (%) |
| Active | ≥ 2 MeV ≥ $1x10^8$ | No | 10 | 30 | 10 | 20 |
| Very Active | ≥ 2 MeV ≥ $1x10^9$ | No | 1 | 1 | 1 | 1 |

**Figure 5: REFM model now showing an upward trend which is accepted, although no CME effects will be accounted for.**




Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2022. All Rights Reserved.